NON-PUBLIC?: N
ACCESSION #: 8909110160
LICENSEE EVENT REPORT (LER)

FACILITY NAME: TROJAN NUCLEAR PLANT PAGE: 1 OF 5

DOCKET NUMBER: 05000344

TITLE: Steam Dump Valve Failure Caused Engineered Safety Feature Actuation
EVENT DATE: 04/06/89 LER #: 89-006-01 REPORT DATE: 08/31/89

OPERATING MODE: 1 POWER LEVEL: 006

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(v)

LICENSEE CONTACT FOR THIS LER:
NAME: Tyrone R. Blackburn, Plant Review Board Engineer

TELEPHONE: 503 556-3713

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JI COMPONENT: PCV MANUFACTURER: C635
X LD PSP X999
X AA RBK W120
REPORTABLE NPRDS: Y
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0024 hours on April 6, 1989, the plant was at 6% power in Mode 1, in the process of a planned shutdown. When the steam dump valves were partially opened as a part of the planned evolution, one of the valves went to the full open position rather than modulating flow. Shortly afterward, the same valve fully shut due to loss of instrument air when the instrument airline leading to the valve ruptured. This sequence of events resulted in an increase in steam generator level in the "C" steam generator due to excessive steam flow. The steam generator reached the High-High alarm setpoint, resulting in feedwater isolation, auxiliary feedwater pump start and steam generator blowdown isolation. The failed valve vas quarantined and plant shutdown recommenced. While continuing the plant shutdown, bank "A" shutdown rods failed to drive in properly. There was no need to withdraw

the rods, so the reactor was manually tripped.

The cause of the event was a broken wire that energized the "trip open" solenoid in the valve control circuitry and opened the valve. A high stress-low cycle fatigue failure of the instrument airline shut the valve. The rods failed to move in due to a thermal cycle/age related failure of a fuse.

Corrective actions were to repair the broken wire, overhaul the affected steam dump valves mechanically and electrically, replace applicable airlines with a flexible tubing, replace all similar rod control fuses, and develop a periodic replacement program for this type of rod control fuse.

This event had no effect on public health and safety.

END OF ABSTRACT

DESCRIPTION OF OCCURRENCE

At 0024 hours on April 6, 1989, the plant was at 6% power in Mode 1, in the process of a planned shutdown in preparation for a scheduled refueling outage. Following the scheduled manual trip of the main turbine, the steam dump valves (PCV-507A, B & C) received a signal to open to control main steam pressure. This was the normal and expected action.

The three valves should have modulated to the same position, since each receives the same signal. However, PCV-507A immediately went to the fully-open position, while the other two valves went to 30-60% open.

The system engineer, who had been monitoring these valves as a part of the shutdown monitoring process, immediately communicated this situation to the control room, and personnel were dispatched to isolate valve PCV-507A. Before the operations personnel could reach the valve, the valve went fully closed, while the two remaining valves continued to modulate flow in response to the signals being received. The valve closure was also observed and promptly reported to the control room by the system engineer.

Immediate investigation of PCV-507A by the system engineer showed that the copper instrument airline leading to the valve operator had separated from its connection. This condition was communicated to the control room, and personnel were immediately dispatched to isolate the airline.

Because of the steam generator water level phenomenon known as "swell", excessive steam flow resulting from the dump valve being fully open caused an increase in steam generator level. This subsequently resulted in a steam

generator High-High level which initiated a feedwater isolation, auxiliary feedwater pump start and a steam generator blowdown isolation (all Engineered Safety Features actuations). All isolation valves and the two safety-related auxiliary feedwater pumps operated as required. The plant continued to operate and, once the transient was over, plant shutdown progressed normally.

The system engineer was observing the evolution in progress because the valves involved (Copes-Vulcan Model D-100-160, 8-inch) had been observed to operate erratically in the past. It was also noted that PCV-507B exhibited some erratic behavior during this event, although it did act to modulate flow.

During the course of the event, it was observed that the Bank "A" shutdown rods would not drive in properly. The rod drives were stopped and investigation initiated to ascertain the cause of the failure. It was determined that there was no need to withdraw the rods in the course of the investigation of the failure to properly drive in, so the reactor trip breakers were manually opened to complete the reactor shutdown and all withdrawn rods dropped with no indication of further problems.

CAUSE OF OCCURRENCE

Investigation identified a broken wire connection in the valve control circuitry. The connection had been damaged (during either installation or a maintenance activity) and was susceptible to breakage. A plausible scenario is this damaged connection broke and grounded, thus energizing the "trip open" solenoid valve and causing the observed failure of the steam valve.

The copper instrument air hose broke due to high stress-low cycle fatigue, caused at least in part by the transient. The subsequent loss of control air shut the valve (air-to-open).

The cause of the failure of the control rods to not drive in properly was a failure of a fuse in the Control Rod Drive Mechanism (CRDM) stationary gripper phase "A" supply. This caused the rod control system to enter the "Urgent Failure Mode" because of the reduced current. During the "Urgent Failure Mode," movement of the CRDMs is disabled. During the outage a similar fuse in the CRDM stationary gripper phase "D" supply failed. Trending analysis indicated a thermal cycle/age relation in the failure of these fuses.

CORRECTIVE ACTIONS

Immediate corrective action for the steam dump valve failure was to isolate the valve, restore normal feedwater flow and steam generator blowdown and

continue with the plant shutdown.

An overhaul and evaluation of the steam dump system was performed as planned to correct previously identified deficiencies associated with these valves. The project included an inspection, functional check and/or testing on each individual electrical and mechanical component related to the pressure control mode of the steam dump system.

The corrective actions for this event taken during the overhaul are as follows:

1. Repair of a broken electrical lead. A broken electrical lead was the cause of the malfunctioning steam dump valve for which this report was initiated. The
wire caused the valve to "trip" open
rather than to modulate. This failure is considered an isolated incident as it failed due to a pre-existing flaw and is not of generic concern.

2. Replacement of 1/4 inch copper instrument air lines with flexible hose at all sections susceptible to high stress-low cycle failure. An evaluation of the airlines leading to these valves was accomplished, and showed the observed failure was due to high stress-low cycle fatigue. The applicable copper airlines were replaced with a flexible hosing that is not susceptible to this type of failure. The new flexible hosing solves the fatigue failure problem and meets all other requirements.

Additional actions taken during the overhaul to correct previously known or suspected deficiencies are as follows:

1. Recalibration of the electro/pneumatic (I/P) transducers.

2. Installation of stroke limiting sleeves.

3. Calibration adjustment and dynamic tuning of the "pressure control mode" pressure controllers.

4. Functional testing of the summators responsible for dividing the pressure controller signals between the four banks of valves.

5. Repacking of valves.

6. Replacement of the trims and stems.

7. Build-up and re-machining of the upper gasket seating area and valve covers.

8. Straightening of the diaphragm plate and the diaphragm retaining bolts.

9. Securing and realigning the positioner cams.

10. Adjustment of the amount of pressure exerted against the valve by the spring (bench set) to keep it closed.

11. Replacement/adjustment of the volume boosters.

12. Elimination of mechanical interference.

13. Elimination of minor air leaks.

14. Adjustment of pressure sets to the proper operating pressure.

15. Repairs of a positioner gearing.

16. Replacement of a failed air pressure regulator.

17. Repair of a malfunctioning position indicator.

18. Repair of a positioner linkage.

The results of the overhaul were verified during actual operation by closely monitoring the system. The monitoring program utilized 10 channel inputs to 3 chart recorders, position transducers at the first steam dump bank and observations by plant personnel to determine the success of the overhaul and any improvements that might be necessary. The test also allowed dynamic tuning of the pressure controller. The test was valuable as it facilitated a comprehensive evaluation of the pressure controller characteristics.

The techniques and procedures developed for the overhaul program will be evaluated for inclusion in the preventive maintenance system for steam dump valves prior to March 31, 1990. (CTL # 30380)

All the fuses in the CRDM stationary gripper supplies were replaced and the system successfully retested. Further troubleshooting did not establish evidence for additional causes of the blown fuses. There were no system faults or apparent high voltage/current conditions that would have caused

the fuses to fail. The CRDM stationary gripper supply fuses will be placed in a scheduled fuse replacement program prior to the 1990 outage. (CTL # 30381)

SIGNIFICANCE OF OCCURRENCE

The steam dump valve failure was appropriately responded to by plant safety systems. Control of the plant was maintained and the shutdown proceeded in an orderly fashion. There was no effect on public health and safety from this event.

ATTACHMENT 1 TO 8909110160 PAGE 1 OF 1

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US Nuclear Regulatory commission
Document Control Desk
Washington, D. C. 20555

Gentlemen:

Licensee Event Report No. 89-06, Revision 1, is attached. This report discusses an event in which a steam dump valve failure resulted in actuation of Engineered Safety Features during plant shutdown.

Sincerely,

C. P. Yundt
General Manager
Trojan Nuclear Plant

c: Mr. John B. Martin
Regional Administrator
US Nuclear Regulatory Commission

Mr. David Stewart-Smith
State of Oregon
Department of Energy

Mr. R. C. Barr
USNRC Resident Inspector
Trojan Nuclear Plant

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